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UTILITY PATENT APPLICATION TRANSMITTAL
(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No. _____042390.P9730_____   Total Pages __2__

First Named Inventor or Application Identifier __Frank P. Hart, et al.__

Express Mail Label No. ____EL431886011US____

ADDRESS TO:	Assistant Commissioner for Patents
	Box Patent Application
	Washington, D. C. 20231

APPLICATION ELEMENTS
See MPEP chapter 600 concerning utility patent application contents.

1. __X__ Fee Transmittal Form
(Submit an original, and a duplicate for fee processing)

2. __X__ Specification (Total Pages ___23___)
(preferred arrangement set forth below)
- Descriptive Title of the Invention
- Cross References to Related Applications
- Statement Regarding Fed sponsored R & D
- Reference to Microfiche Appendix
- Background of the Invention
- Brief Summary of the Invention
- Brief Description of the Drawings (if filed)
- Detailed Description
- Claims
- Abstract of the Disclosure

3. __X__ Drawings(s) (35 USC 113) (Total Sheets _7_)

4. __X__ Oath or Declaration (Total Pages _6_)

  a. ____ Newly Executed (Original or Copy)

  b. ____ Copy from a Prior Application (37 CFR 1.63(d))
  (for Continuation/Divisional with Box 17 completed) **(Note Box 5 below)**

  i. ____ DELETIONS OF INVENTOR(S) Signed statement attached deleting
  inventor(s) named in the prior application, see 37 CFR 1.63(d)(2)
  and 1.33(b).

5. ____ Incorporation By Reference (useable if Box 4b is checked)
The entire disclosure of the prior application, from which a copy of the oath or
declaration is supplied under Box 4b, is considered as being part of the
disclosure of the accompanying application and is hereby incorporated by
reference therein.

6. ____ Microfiche Computer Program (Appendix)

12/01/97   - 1 -   PTO/SB/05 (12/97)

7. _____ Nucleotide and/or Amino Acid Sequence Submission
(if applicable, all necessary)
   a. _____ Computer Readable Copy
   b. _____ Paper Copy (identical to computer copy)
   c. _____ Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

8. _____ Assignment Papers (cover sheet & documents(s))

9. _____ a. 37 CFR 3.73(b) Statement (where there is an assignee)

   _____ b. Power of Attorney

10. _____ English Translation Document (if applicable)

11. _____ a. Information Disclosure Statement (IDS)/PTO-1449

   _____ b. Copies of IDS Citations

12. _____ Preliminary Amendment

13. __X__ Return Receipt Postcard (MPEP 503) (Should be specifically itemized)

14. _____ a. Small Entity Statement(s)

   b. Statement filed in prior application, Status still proper and desired

15. _____ Certified Copy of Priority Document(s) (if foreign priority is claimed)

16. __X__ Other: Certificate of Express Mail with copy of postcard showing contents of
   Express Mail package.

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17. **If a CONTINUING APPLICATION, check appropriate box and supply the requisite information:**

   _____ Continuation   _____ Divisional   _____ Continuation-in-part (CIP)

   of prior application No: _____

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18. **Correspondence Address**

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__X__ Correspondence Address Below

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PTO/SB/17(6/99)
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FEE TRANSMITTAL FOR FY 2000

TOTAL AMOUNT OF PAYMENT ($)   1,182.00

Complete if Known:

Application No.	Not Yet Assigned
Filing Date	Herewith
First Named Inventor	Frank P. Hart, et al
Group Art Unit	Not Yet Assigned
Examiner Name	Not Yet Assigned
Attorney Docket No.	042390.P9730

METHOD OF PAYMENT (check one)

1.   [X]   The Commissioner is hereby authorized to charge indicated fees and credit
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2.   X   Payment Enclosed:
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FEE CALCULATION

1.   BASIC FILING FEE

Large Entity		Small Entity				
Fee Code	Fee ($)	Fee Code	Fee ($)	Fee Description		Fee Paid
101	690	201	345	Utility application filing fee		690 00
106	310	206	155	Design application filing fee		_____
107	480	207	240	Plant filing fee		_____
108	690	208	345	Reissue filing fee		_____
114	150	214	75	Provisional application filing fee		_____

SUBTOTAL (1) $ 690.00

2.   EXTRA CLAIM FEES

		Extra Claims			Fee from below		Fee Paid
Total Claims	30	− 20** =	10	X	18	=	180.00
Independent Claims	7	− 3** =	4	X	78	=	312.00
Multiple Dependent						=	_____

Or number previously paid, if greater; For Reissues, see below.

Large Entity		Small Entity			
Fee Code	Fee ($)	Fee Code	Fee ($)	Fee Description	
103	18	203	9	Claims in excess of 20	
102	78	202	39	Independent claims in excess of 3	
104	260	204	130	Multiple dependent claim, if not paid	
109	78	209	39	**Reissue independent claims over original patent	
110	18	210	9	**Reissue claims in excess of 20 and over original patent	

SUBTOTAL (2) $ 492.00

Patent fees are subject to annual revisions. Small Entity payments must be supported by a small entity statement, otherwise large
entity fees must be paid.
See Forms PTO/SB/09-12

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity		Small Entity				
Fee Code	Fee ($)	Fee Code	Fee ($)	Fee Description		Fee Paid
105	130	205	65	Surcharge - late filing fee or oath		_____
127	50	227	25	Surcharge - late provisional filing fee or cover sheet		_____
139	130	139	130	Non-English specification		_____
147	2,520	147	2,520	For filing a request for reexamination		_____
112	920*	112	920*	Requesting publication of SIR prior to Examiner action		_____
113	1,840*	113	1,840*	Requesting publication of SIR after Examiner action		_____
115	110	215	55	Extension for response within first month		_____
116	380	216	190	Extension for response within second month		_____
117	870	217	435	Extension for response within third month		_____
118	1,360	218	680	Extension for response within fourth month		_____
128	1,850	228	925	Extension for response within fifth month		_____
119	300	219	150	Notice of Appeal		_____
120	300	220	150	Filing a brief in support of an appeal		_____
121	260	221	130	Request for oral hearing		_____
138	1,510	138	1,510	Petition to institute a public use proceeding		_____
140	110	240	55	Petition to revive unavoidably abandoned application		_____
141	1,210	241	605	Petition to revive unintentionally abandoned application		_____
142	1,210	242	605	Utility issue fee (or reissue)		_____
143	430	243	215	Design issue fee		_____
144	580	244	290	Plant issue fee		_____
122	130	122	130	Petitions to the Commissioner		_____
123	50	123	50	Petitions related to provisional applications		_____
126	240	126	240	Submission of Information Disclosure Stmt		_____
581	40	581	40	Recording each patent assignment per property (times number of properties)		_____
146	690	246	345	For filing a submission after final rejection (see 37 CFR 1.129(a))		_____
149	690	249	345	For each additional invention to be examined (see 37 CFR 1.129(a))		_____

Other fee (specify) _____ _____

Other fee (specify) _____ _____

SUBTOTAL (3) $ ____0____

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SUBMITTED BY:

Typed or Printed Name: John Patrick Ward, Esq.

Signature _____ Date 9/29/00

Reg. Number 40,216 Deposit Account User ID _____
(complete if applicable)

UNITED STATES PATENT APPLICATION

FOR

METHOD AND APPARATUS FOR BOOTING THE OPERATING

ENVIRONMENT OF AN AUTONOMOUS SUBSYSTEM IN A COMPUTER

BASED SYSTEM WITHOUT INVOLVEMENT OF THE MAIN OPERATING

SYSTEM

INVENTORS:

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Date of Deposit   September 29, 2000

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METHOD AND APPARATUS FOR BOOTING THE OPERATING ENVIRONMENT OF AN AUTONOMOUS SUBSYSTEM IN A COMPUTER BASED SYSTEM WITHOUT INVOLVEMENT OF THE MAIN OPERATING SYSTEM

FIELD OF THE INVENTION

The present invention pertains to the field of computers. More particularly, the present invention relates to booting the operating environment of a subsystem without involvement of the main operating system.

BACKGROUND OF THE INVENTION

Computer based systems are becoming more mobile. This mobility often places an emphasis on usability. Usability is often extended by the ability to operate the equipment for longer periods of time. This time period is often related to the power consumption of the equipment, particularly in battery operated equipment. Thus, high power consumption may pose problems.

Numerous approaches to reducing power consumption have been tried. Powering off equipment when not in active use is one approach. Other approaches involve putting equipment in various lower power states, such as, idle mode, sleep mode, hibernation mode, etc. Such approaches may involve turning off portions of circuits or components, powering down subsystems and/or the main system, lowering supply voltages, altering clocking mechanisms, transferring data from, for example, random access memory (RAM) to disk storage, etc.

Upon exiting such lower power states the computer based system may resume or boot up the operating system. After booting up or resuming operation of the operating system an application may be executed to perform operations. Time required to boot up the operating system may present a problem for a subsystem that 5 needs a rapid response. Power consumed during the boot up process may also present a problem for battery operated equipment.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention is illustrated by way of example and not limitation in the figures of the accompanying drawings, in which like references indicate similar elements and in which:

Figure 1 illustrates a networked computer environment;

Figure 2 is a block diagram of a computer system;

Figures 3, 4, and 5 are flow diagrams illustrating various embodiments of the invention; and

Figures 6, and 7 are block diagrams illustrating various embodiments of the present invention.

DETAILED DESCRIPTION

A method and apparatus for booting the operating environment of an autonomous subsystem in a computer based system without involvement of the main operating system are described. For purposes of discussing the invention, it is to be

5   understood that various terms are used by those knowledgeable in the art to describe the sequence by which a system may start itself up. Such a start up is often referred to as a boot or booting process. Booting may be from, for example, an initial application of power to the device, often called a power on or cold boot. Booting may be from a system that is partially powered up already. Booting may be from a system fully

10   powered up, often called a warm boot or reset. It is to be understood that the boot sequence involves acquiring additional instructions and/or data as the result of a stimulus, such as a power switch, a reset button, a received signal, etc. The acquisition of additional instructions and/or data may be from, for example, a hard disk, a floppy disk, a network, flash memory, etc. The result of the boot process is to

15   place the computer based device in an operation mode where is it capable of receiving additional information and executing programs. An example would be the power up sequence of a personal computer using a Windows® operating system or the Linux® operating system.

It is to be understood that the term shutdown may, but is not limited to,

20   controlling a device, system, or subsystem by completely shutting off power, partially shutting down power, operating on a different voltage, operating at a different frequency, etc. A device, system, subsystem, or equipment that is shutdown is intended, among other things, to reduce power consumption. There are numerous approaches to reducing power consumption. Powering off equipment when not in

25   active use is one approach. Other approaches involve putting equipment in various

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lower power states, such as, idle mode, sleep mode, hibernation mode, etc. Such

approaches may involve turning off portions of circuits or components, powering

down subsystems and/or the main system, lowering supply voltages, altering clocking

mechanisms, etc.

5   A machine-readable medium is understood to include any mechanism for storing or

transmitting information in a form readable by a machine (e.g., a computer). For example,

a machine-readable medium includes read only memory (ROM); random access memory

(RAM); magnetic disk storage media; optical storage media; flash memory devices;

electrical, optical, acoustical or other form of propagated signals (e.g., carrier waves,

10   infrared signals, digital signals, etc.); etc.

        Figure 1 illustrates a network environment in which the techniques described may

be applied. As shown, several computer systems in the form of M servers 104-1 through

104-M and N clients 108-1 through 108-N are connected to each other via a network, which

may be, for example, the Internet. Note that alternatively the network 102 might be or

15   include one or more of: a Local Area Network (LAN), Wide Area Network (WAN),

satellite link, fiber network, cable network, or a combination of these and/or others. The

method and apparatus described herein may be applied to essentially any type of

communicating means or device whether local or remote, such as a LAN, a WAN, a system

bus, a disk drive, storage, etc.

20   Figure 2 illustrates a conventional personal computer in block diagram form, which

may be representative of any of the clients and servers shown in Figure 1. The block

diagram is a high level conceptual representation and may be implemented in a variety of

ways and by various architectures. Bus system 202 interconnects a Central Processing

Unit (CPU) 204, Read Only Memory (ROM) 206, Random Access Memory (RAM) 208,

25   storage 210, display 220, audio, 222, keyboard 224, pointer 226, miscellaneous input/output

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(I/O) devices 228, and communications 230. The bus system 202 may be for example, one or more of such buses as a system bus, Peripheral Component Interconnect (PCI), Advanced Graphics Port (AGP), Small Computer System Interface (SCSI), Institute of Electrical and Electronics Engineers (IEEE) standard number 1394 (FireWire), etc. The

5   CPU 204 may be a single, multiple, or even a distributed computing resource. The ROM 206 may be any type of non-volatile memory, which may be programmable such as, mask programmable, flash, etc. RAM 208 may be, for example, static, dynamic, synchronous, asynchronous, or any combination. Storage 210, may be Compact Disc (CD), Digital Versatile Disk (DVD), hard disks, optical disks, tape, flash, memory sticks, video recorders,

10   etc. Display 220 might be, for example, a Cathode Ray Tube (CRT), Liquid Crystal Display (LCD), a projection system, Television (TV), etc. Audio 222 may be a monophonic, stereo, three dimensional sound card, etc. The keyboard 224 may be a keyboard, a musical keyboard, a keypad, a series of switches, etc. The pointer 226, may be, for example, a mouse, a touchpad, a trackball, joystick, etc. I/O devices 228, might be a

15   voice command input device, a thumbprint input device, a smart card slot, a Personal Computer Card (PC Card) interface, virtual reality accessories, etc., which may optionally connect via an input/output port 229 to other devices or systems. An example of a miscellaneous I/O device 228 would be a Musical Instrument Digital Interface (MIDI) card with the I/O port 229 connecting to the musical instrument(s). Communications device 230

20   might be, for example, an Ethernet adapter for local area network (LAN) connections, a satellite connection, a settop box adapter, a Digital Subscriber Line (xDSL) adapter, a wireless modem, a conventional telephone modem, a direct telephone connection, a Hybrid-Fiber Coax (HFC) connection, cable modem, etc. The external connection port 232 may provide for any interconnection, as needed, between a remote device and the bus

25   system 202 through the communications device 230. For example, the communications

device 230 might be an Ethernet adapter, which is connected via the connection port 232 to, for example, an external DSL modem. Note that depending upon the actual implementation of a computer system, the computer system may include some, all, more, or a rearrangement of components in the block diagram. For example, a thin client might

5   consist of a wireless hand held device that lacks, for example, a traditional keyboard. Thus, many variations on the system of Figure 2 are possible.

        Referring back to Figure 1, clients 108-1 through 108-N are effectively connected to web sites, application service providers, search engines, and/or database resources represented by servers, such as servers 104-1 through 104-M, via the

10   network 102. The web browser and/or other applications are generally running on the clients 108-1 through 108-N, while information generally resides on the servers 104-1 through 104-M. For ease of explanation, a single client 108-1 will be considered to illustrate one embodiment of the present techniques. It will be readily apparent that such techniques can be easily applied to multiple clients.

15   In Figure 1, the client 108-1 may be running a boot sequence that has the capability to access the network. This capability would allow booting or any updates thereto from a server via the Internet and/or other network. A description of the method of updating or installation of any revised booting code and/or data is not necessary for an understanding of the present invention.

20   The information required for booting a device, such as a subsystem, in the present invention may, but is not limited to, embodiment in the CPU 204, the ROM 206, the Storage 210, etc. This boot information may consist of, but is not limited to, subsystem boot indicators, actual boot code and/or data for booting a subsystem, etc. Additionally, accesses through, for example, the Communications device 230 which

25   might be, for example, an Ethernet adapter would allow access to a network wherein

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the information such as a subsystem boot indicator and/or the boot code information may be retrieved.

A subsystem may be, but is not limited to, one or more of the elements of Figure 2. For example, Storage 210 may have a subsystem that handles how data is to be stored and retrieved. Audio 222 may have a subsystem that handles when to, for example, power down speakers. Communications device 230 may, for example, have a subsystem that needs to boot up independently of the main system upon receiving a message.

Figure 3 is a high level block diagram of one embodiment of the present invention. A subsystem boot indicator is retrieved 302. Based on the subsystem boot indicator retrieved 302, it is determined whether to boot up the subsystem 304. If the retrieved subsystem boot indicator 302 does not indicate a boot of the subsystem, then other options 308 may be available. If a boot of the subsystem is indicated then information is transferred to the subsystem 306.

The subsystem boot indicator may be, but is not limited to, a bit or bits in a memory location; information stored remote to the subsystem, for example, a main system or even more remote such as somewhere on an Internet web site; non-volatile storage, such as a hard disk, DVD, flash, etc.; or something as simple as a jumper across pins on a device. What is to be understood is that the subsystem boot indicator in whatever form and wherever located is an indication of the subsystem boot status and/or a requested boot operation. It is also to be understood that single as well as multiple resources may inquire into the status of the indicator or indicators. That is, for example, a power controller in a system may inquire as to the state of a subsystem boot indicator, as well as may a main system processor or even a remote client or server.

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If the retrieved subsystem boot indicator 302 does not indicate a request to boot up the subsystem 304, then other options 308 may be available. For example, the subsystem boot indicator may contain information indicating that a previous boot attempt was unsuccessful and that some corrective action may be required.

5   Figure 4 is another embodiment of the present invention. A boot up process is started 402 during which a boot indicator is retrieved 404. Based upon the boot indicator retrieved 404 information is then transferred to the subsystem 406 after which the system is shut down 408.

Shut down 408, may but is not limited to, shutting down an entire system, a
10   main system, subsystems, etc. For example, after information is transferred to the subsystem 406, the shutdown 408 may involve shutting down the main system and keeping a subsystem still active and alive. Thus, a subsystem may, for example, be processing information and operating while the sequence as illustrated in Figure 4 is being performed.

15   An example of such an embodiment might be, but is not limited to, a main system processor, such as a Pentium® processor, starting to boot up, then retrieving a boot indicator from, for example, a flash memory location in a firmware hub, then based on this transferring information to a subsystem memory, and then shutting the main system down. The transferring of information in such a system by the main
20   system processor may be needed because of the inability of a subsystem resource to directly access the information initially. That is, the main system processor may only be able to access the information until such time as it is transferred to the subsystem, after which a subsystem resource may have access. Alternatively, some other system resource, or even the subsystem itself may perform the transferring of information
25   such that the subsystem has access to the information during its boot up.

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Shutting down the system may save on power consumption. For example, the main system processor during a boot up may transfer information to a subsystem and then shut itself down. The subsystem, still powered up, may then use the information transferred by the main processor to boot up. In this way power consumption may be
5   reduced.

It should be noted, that in the examples above, the main processor transfers the information without the need for the main processor to load an operating system, such as, Windows® or Linux®.

Figure 5 is a more detailed flow diagram of an embodiment of the present
10 invention. A subsystem boot indicator is retrieved 502. Based on the subsystem boot indicator retrieved 502, it is determined whether to boot up the subsystem 504. If the retrieved subsystem boot indicator 502 does not indicate a boot of the subsystem, then other options 508 may be available. If a boot of the subsystem is indicated then information is retrieved from a main storage system 506, and then transferred and
15 stored to the subsystem 510. The subsystem then boots using this transferred information 512.

The main system storage may be, but is not limited to, hard disk storage, DVD, CD, ROM, flash, etc. Likewise, the storing of the transferred information may be, but is not limited to, another hard disk, a writeable device, RAM, flash, etc.

20 Figure 6 illustrates one system architecture for embodiment of the present invention. Controller 602 is coupled to: Main system 610 via link 604; Subsystem 618 via link 608; and Subsystem boot indicator 624 via link 606. Main system 610 is additionally coupled to Main system storage 614 via link 612 and Subsystem 618 via link 616. Subsystem 618 is additionally coupled to Subsystem storage 622 via link
25 620.

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An example of one possible mode of operation for the architecture as shown in Figure 6 is as follows. Initially, Main system 610 and Main system storage 614 are powered down. Controller 602 receives a communication via link 608 from Subsystem 618 requesting that Subsystem 618 be booted. Controller 602 then

5   examines the Subsystem boot indicator 624 via link 606 to determine the boot status. Assuming that a boot of the Subsystem 618 is to be performed, Controller 602 may then power up Main system 610 and Main system storage 614. Controller 602 may communicate via link 604 the subsystem boot indicator 624 status to the Main system 610 during its boot up process. Based on the subsystem boot indicator 624 the Main

10   system 610 may then access the Main system storage 614 via link 612, retrieve information and transfer this information via link 616 to Subsystem 618 and via link 620 store it in the Subsystem storage 622. After the transfer of the information is complete, the Controller 602 may power down the Main system 610 and the Main system storage 614. The Subsystem 618 may then proceed to boot up using the

15   information transferred and now stored in Subsystem storage 622.

    After the Main system 610 determines that it is to transfer information to the Subsystem storage 622, it may be necessary for a processor in the Main system 610 to fetch instructions on how to perform this operation. These instructions may be communicated from a variety of sources, for example, the Main system storage 614,

20   the Subsystem storage 622, the Controller 602, a remote server, etc.

    Another example of a possible mode of operation for the architecture as shown in Figure 6 would be to allow the Subsystem 618 to access via link 616 and link 612 directly to the Main system storage 614. In this scenario, the Subsystem 618 may effect the transfer of information from the Main system storage 614 to the Subsystem

25   storage 622 rather than the Main system 610 effecting the transfer as discussed

previously. One skilled in the art will recognize that many other architectures and variations are possible.

Figure 7 illustrates another system architecture for embodiment of the present invention. A host central processing unit (CPU) 702 is coupled via link 703 to a

5　memory controller hub (MCH) 704. The MCH 704 is coupled via link 705 to an input/output controller hub (ICH) 706. The ICH 706 is coupled to a hard disk drive (HDD) 710 via an integrated drive electronics (IDE) 709 link. The IDE 709 also couples the autonomous subsystem 714 to the HDD 710. The ICH 706 is also coupled to the autonomous subsystem 714 via a universal serial bus (USB) 713 link.

10　Additionally the ICH 706 is coupled via a low pin count (LPC) 707 link to an embedded controller (EC) 708, a firmware hub (FWH) 712, and the autonomous subsystem 714. The autonomous subsystem 714 is coupled to the EC 708 via a system management bus (SMB) 721. The autonomous subsystem 714 is coupled to synchronous dynamic random access memory (SDRAM) via link 723. The

15　autonomous subsystem 714 is coupled to a flash electrically programmable read only memory (FEPROM) 716 via link 715. It should be noted that the FEPROM 716 has some memory locations that are used for host boot support 718 and storage of data in a data area 720.

One possible embodiment of the invention in reference to Figure 7 is as

20　follows. The EC 708 enables power to the autonomous subsystem 714, which then examines the data area 720 within the FEPROM 716 to determine if a boot is required. If a boot is required, then the autonomous subsystem 714 informs the EC 708 over the SMB 721 that a boot is required. At this point, the EC 708 may use either the host CPU 702 to effect a transfer of information (denoted as slave mode) or

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the autonomous subsystem 714 to effect the transfer of information (denoted as master mode).

If the host CPU 702 is used to effect the transfer of information, i.e. slave mode, then the EC 708 may power up; the host CPU 702; the MCH 704; the ICH 706; the autonomous subsystem 714; the FEPROM 716 including the host boot support 718; the LPC 707; the USB 713; the IDE 709; and the links 703, 705, and 715. The host CPU 702 may then be vectored (i.e. directed) to the host boot support 718 to fetch instructions and/or data on how to effect the transfer of information. The source or destination of the information may be, but is not limited to, for example, the HDD 710, the FEPROM 716, the FWH 712, the SDRAM 724, a remote client or server, etc. Thus, the host CPU 702 may effect a transfer of information, for example, from the HDD 710 to the SDRAM 724. It is to be understood that any source and/or destination and their respective links would need to be powered up sufficiently to operate properly. After the transfer is complete, the EC 708 may power down the host CPU 702, the MCH 704, the ICH 706, the links 703 and 705, the LPC 707, the USB 713, and the IDE 709. The EC 708 may then communicate to the autonomous subsystem 714 via, for example, the SMB 721, to boot using the information transferred to the SDRAM 724.

In a similar fashion, if the autonomous subsystem 714 resources are used to effect the transfer of information, i.e. master mode, then the EC 708 may power up the HDD 710, the IDE 709, the autonomous subsystem 714; the FEPROM 716, the SDRAM 724, and the links 715 and 723. The autonomous subsystem 714 may then be instructed by the EC 708 via SMB 721 to fetch instructions and/or data from the FEPROM 716 on how to effect the transfer of information. The source or destination of the information may be, but is not limited to, for example, the HDD 710, the

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FEPROM 716, the FWH 712, the SDRAM 724, a remote client or server, etc. Thus, the autonomous subsystem 714 resources may effect a transfer of information, for example, from the HDD 710 to the SDRAM 724. After the transfer is complete, the EC 708 may power down the HDD 710, the IDE 709, and may then communicate to

5   the autonomous subsystem 714 via, for example, the SMB 721, to boot using the information transferred to the SDRAM 724.

The illustrated embodiments of the present invention are to be understood as applicable to a plurality of subsystems within a single and/or distributed system or systems. For example, in a single system, there may be a subsystem handling user

10   input, from for example, a keyboard, while at the same time another subsystem is handling, for example, the transmission and reception of data via a wireless link. In the quest to conserve power these various subsystems may be powering on and booting up and then powering down asynchronously. For example, a keyboard subsystem may power up only when a key is being activated and may power down

15   between keystrokes. Similarly, a communications subsystem may only power up when transmission or reception is necessary.

Thus, a method and apparatus for booting the operating environment of a subsystem without involvement of the main operating system have been described. Although the present invention has been described with reference to specific

20   exemplary embodiments, it will be evident that various modifications and changes may be made to these embodiments without departing from the broader spirit and scope of the invention as set forth in the claims. Accordingly, the specification and drawings are to be regarded in an illustrative rather than a restrictive sense.

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What is claimed is:

1. A method for booting a subsystem, comprising:

      retrieving a subsystem boot indicator; and

      transferring information to the subsystem based on the subsystem boot indicator.

2. The method according to claim 1, wherein the subsystem boot indicator is located in a non-volatile storage device.

3. The method according to claim 2, wherein the non-volatile storage device is located within the subsystem.

4. The method according to claim 1, wherein transferring information to the subsystem is performed without involvement of a main system operating system.

5. The method according to claim 4, wherein transferring information to the subsystem is performed over a bus whose width is less than that of the main system.

6. The method according to claim 4, wherein transferring information to the subsystem is performed over a communication link whose bandwidth is less than that of the main system.

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1 7. The method according to claim 1, wherein transferring information to the
2 subsystem is transferring information to a memory accessible by the subsystem.

1 8. A method comprising:
2   starting a boot up of a system;
3   retrieving a boot indicator;
4   transferring information inaccessible to a subsystem to a location accessible by
5 the subsystem based upon the boot indicator; and
6   shutting down the system.

1 9. The method according to claim 8, wherein shutting down the system occurs before
2 a main operating system for the system has substantially started executing.

1 10. The method according to claim 8, wherein shutting down the system does not
2 shut down the subsystem.

1 11. The method according to claim 8, wherein the location is a memory location.

1 12. A machine-readable medium having stored thereon instructions, which when
2 executed by a processor, causes said processor to perform the following:
3   retrieve a subsystem boot indicator; and
4   transfer information to a subsystem based on the subsystem boot indicator.

1 13. The machine-readable medium according to claim 12, wherein transferring the

2 information to a subsystem comprises transferring the information to a storage

3 accessible by the subsystem.

1 14. The machine-readable medium according to claim 12, wherein retrieving the

2 subsystem boot indicator is retrieving the subsystem boot indicator from a non-

3 volatile storage device.

1 15. A method for booting a subsystem, comprising:

2   retrieving a subsystem boot indicator;

3   determining from the retrieved subsystem boot indicator whether to perform a

4 boot; and

5   performing a requested boot.

1 16. The method of claim 15, wherein performing a requested boot comprises:

2   retrieving information from a main system storage;

3   transferring the retrieved information to the subsystem;

4   storing the transferred information in a location accessible by the subsystem;

5   and

6   booting the subsystem from the stored information in the location accessible

7 by the subsystem.

1 17. The method of claim 16, wherein retrieving information and transferring the

2 retrieved information is substantially performed by a main system resource.

1   18. The method of claim 16, wherein retrieving information and transferring the

2   retrieved information is substantially performed by a subsystem resource.

1   19. The method of claim 15, wherein retrieving the subsystem boot indicator

2   comprises retrieving a subsystem boot indicator from the subsystem to be booted.

1   20. A booting system comprising:

2   a main system;

3   a subsystem coupled to the main system;

4   a main storage device accessible by the main system;

5   a subsystem storage device accessible by the subsystem;

6   a subsystem boot indicator; and

7   a controller coupled to the main system and the subsystem.

1   21. The system of claim 20, wherein the main storage device is a non-volatile

2   memory storage device.

1   22. The system of claim 20, wherein the subsystem storage device is a volatile

2   memory device.

1   23. The system of claim 20, wherein the subsystem boot indicator is accessible by the

2   controller.

1   24. An apparatus for booting a subsystem, comprising:

2   means for retrieving a subsystem boot indicator;

3   means for determining from the retrieved subsystem boot indicator whether to

4   perform a boot; and

5   means for performing a requested boot.

1   25. The apparatus of claim 24, wherein means for performing a requested boot

2   comprises:

3   means for allowing a subsystem access to a main system storage;

4   means for retrieving information from the main system storage;

5   means for transferring the retrieved information to the subsystem;

6   means for storing the transferred information in a location accessible by the

7   subsystem; and

8   means for booting the subsystem from the stored information in the location

9   accessible by the subsystem.

1   26. The apparatus of claim 24, wherein means for performing a requested boot

2   comprises:

3   means for allowing a main system access to a main system storage;

4   means for retrieving information from the main system storage;

5   means for transferring the retrieved information to the subsystem;

6   means for storing the transferred information in a location accessible by the

7   subsystem; and

8   means for booting the subsystem from the stored information in the location

9   accessible by the subsystem.

1   27. A computer based system comprising:

2   a main system with a first storage device, the main system capable of running

3   a main operating system;

4   a subsystem with a second storage device;

5   a subsystem boot indicator; and

6   a boot up controller capable of accessing the subsystem boot indicator and

7   initiating a booting of the subsystem based upon the subsystem boot indicator.

1   28. The computer based system according to claim 27, wherein the booting of the

2   subsystem comprises:

3   means for retrieving information from the first storage device;

4   means for transferring the retrieved information to the second storage device;

5   and

6   means for booting the subsystem using the information in the second storage

7   device.

1   29. The computer based system according to claim 28, wherein means for retrieving

2   information and means for transferring the retrieved information is performed

3   substantially by a main system resource without the use of the main operating system.

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1 30. The computer based system according to claim 28, wherein means for retrieving

2 information and means for transferring the retrieved information is substantially

3 performed by a subsystem resource.

ABSTRACT OF THE DISCLOSURE

A method and apparatus for booting the operating environment of an autonomous subsystem in a computer based system without involvement of the main operating system are described.
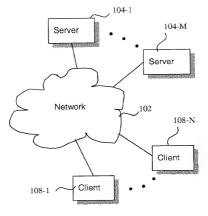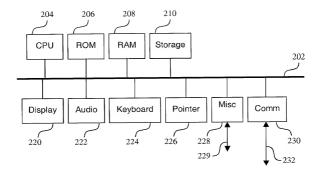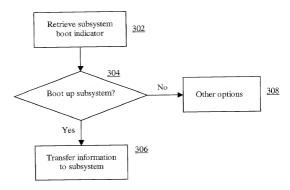
5

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Figure 1

Figure 2

Figure 3

402 Start boot up

404 Retrieve boot indicator

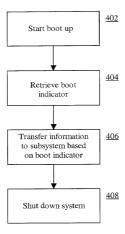406 Transfer information to subsystem based on boot indicator

408 Shut down system

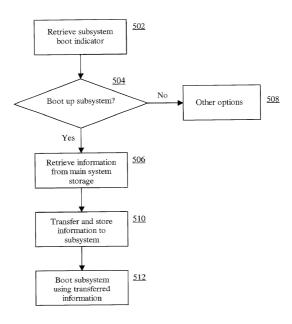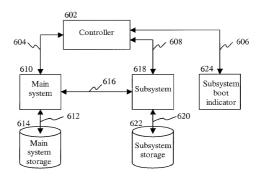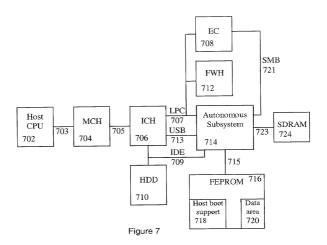Figure 4

Figure 5

Figure 6

Figure 7

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION
(FOR **INTEL CORPORATION** PATENT APPLICATIONS)

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below, next to my name.

I believe I am the original, first, and sole inventor (if only one name is listed below) or an original, first, and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled
  METHOD AND APPARATUS FOR BOOTING THE OPERATING ENVIRONMENT OF AN
  AUTONOMOUS SUBSYSTEM IN A COMPUTER BASED SYSTEM WITHOUT INVOLVEMENT
  OF THE MAIN OPERATING SYSTEM
the specification of which

        X   is attached hereto.
       ____ was filed on (MM/DD/YYYY) _____ as
                United States Application Number _____
                or PCT International Application Number_____
                and was amended on (MM/DD/YYYY) _____.
                                              (if applicable)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claim(s), as amended by any amendment referred to above. I do not know and do not believe that the claimed invention was ever known or used in the United States of America before my invention thereof, or patented or described in any printed publication in any country before my invention thereof or more than one year prior to this application, that the same was not in public use or on sale in the United States of America more than one year prior to this application, and that the invention has not been patented or made the subject of an inventor's certificate issued before the date of this application in any country foreign to the United States of America on an application filed by me or my legal representatives or assigns more than twelve months (for a utility patent application) or six months (for a design patent application) prior to this application.

I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d), of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)

(Number)	(Country)	(Foreign Filing Date - MM/DD/YYYY)	Yes	No
(Number)	(Country)	(Foreign Filing Date - MM/DD/YYYY)	Yes	No
(Number)	(Country)	(Foreign Filing Date - MM/DD/YYYY)	Yes	No

I hereby claim the benefit under Title 35, United States Code, Section 119(e) of any United States provisional application(s) listed below:

Application Number   (Filing Date – MM/DD/YYYY)

Application Number   (Filing Date – MM/DD/YYYY)

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, Section 112, I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

Application Number   (Filing Date – MM/DD/YYYY)   Status -- patented, pending, abandoned

Application Number   (Filing Date – MM/DD/YYYY)   Status -- patented, pending, abandoned

I hereby appoint the persons listed on Appendix A hereto (which is incorporated by reference and a part of this document) as my respective patent attorneys and patent agents, with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith.

Send correspondence to ___John Patrick Ward_____, BLAKELY, SOKOLOFF, TAYLOR & (Name of Attorney or Agent)
ZAFMAN LLP, 12400 Wilshire Boulevard 7th Floor, Los Angeles, California 90025 and direct telephone calls to ___John Patrick Ward_____, (408) 720-8300.
                        (Name of Attorney or Agent)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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Inventor's Signature _____ Date _____

Residence _____ Citizenship _____
                        (City, State)   (Country)

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Full Name of Second/Joint Inventor ___Edward J. Pole_____

Inventor's Signature _____ Date _____

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Full Name of Third/Joint Inventor ___Kelan Silvester_____

Inventor's Signature _____ Date _____

Residence _____ Citizenship _____
                        (City, State)   (Country)

Post Office Address _____
                   _____

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Full Name of Third/Joint Inventor __Paul Zurcher_____

Inventor's Signature _____ Date _____

Residence _____ Citizenship _____
              (City, State)   (Country)

Post Office Address _____
_____

　APPENDIX A

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APPENDIX B

Title 37, Code of Federal Regulations, Section 1.56
Duty to Disclose Information Material to Patentability

(a) A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclose information exists with respect to each pending claim until the claim is cancelled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is cancelled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclosure all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in a patent was cited by the Office or submitted to the Office in the manner prescribed by §§1.97(b)-(d) and 1.98. However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:

(1) Prior art cited in search reports of a foreign patent office in a counterpart application, and

(2) The closest information over which individuals associated with the filing or prosecution of a patent application believe any pending claim patentably defines, to make sure that any material information contained therein is disclosed to the Office.

(b) Under this section, information is material to patentability when it is not cumulative to information already of record or being made or record in the application, and

(1) It establishes, by itself or in combination with other information, a prima facie case of unpatentability of a claim; or

(2) It refutes, or is inconsistent with, a position the applicant takes in:

(i) Opposing an argument of unpatentability relied on by the Office, or

(ii) Asserting an argument of patentability.

A prima facie case of unpatentability is established when the information compels a conclusion that a claim is unpatentable under the preponderance of evidence, burden-of-proof standard, giving each term in the claim its broadest reasonable construction consistent with the specification, and before any consideration is given to evidence which may be submitted in an attempt to establish a contrary conclusion of patentability.

(c) Individuals associated with the filing or prosecution of a patent application within the meaning of this section are:

(1) Each inventor named in the application;

(2) Each attorney or agent who prepares or prosecutes the application; and

(3) Every other person who is substantively involved in the preparation or prosecution of the application and who is associated with the inventor, with the assignee or with anyone to whom there is an obligation to assign the application.

(d) Individuals other than the attorney, agent or inventor may comply with this section by disclosing information to the attorney, agent, or inventor.

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